Equine Science & Management

Section 6 Reproduction

Supplement
Section 6  Equine Reproduction

Goal:
The student will develop an understanding of the many facets involved with equine conception and foaling.

Objectives:

1. to learn the numerous factors that affect breeding stock selection

2. to identify the parts of the male and female reproductive anatomy

3. to become familiar with the skills necessary for pregnancy determination, gestational care and foaling
Equine Reproduction

Introduction
Throughout history, the horse has served humankind as beast of burden, a means of transportation and companion. Horses have been at the center of the development of many civilizations and cultures, and these equines have had many roles in our history. Although the role of horse has changed with industrialization and the move from rural to urban lifestyles, horses remain part of our lives through sports, shows, racing and similar competitions; pleasure and recreation; careers; agricultural work; rehabilitation assistance and other areas. Producing the best horse possible is still a concern among horse breeders, trainers and owners.

This study guide is designed to complement the section Equine Reproduction by expanding on the information and by presenting additional material not found in the video. Using both the video and the study guide will increase your comprehension of the subject matter. The study guide will help you understand some of the basics of horse reproduction, including background of breeding horses for selected traits, stallion and mare reproductive systems, the estrus cycle, natural and artificial insemination processes, pregnancy care and complications, the foaling process and post-delivery care for the mare and foal. The study guide also contains anatomy and term definitions, a quiz and labeling sheets for male and female equine reproductive anatomy. Answer keys are included for the teacher’s use.

History of Selection Processes
Humankind has changed the horse through selection practices, both intentional and unintentional. When the farmer kept "Big John" because he was a good plow horse and “Lady” because she was a good riding horse, this helped determine the future stock on his farm. On the other hand, "Old Bay" with a nasty temper was happily sold to a rodeo show. This was also a form of selection. Most likely, farmers would breed their best mares to Big John. This type of selection where owners choose sires and dams based on characteristics they wanted to encourage or modify had a profound effect horse development.

Development of Breeds: The development of many breeds came about just this way. Arabians needed a swift horse with endurance to withstand long runs in the hot desert. The toughest, fastest horses naturally survived best in this climate and were so selected. As a result, the Arabian breed was developed. Farmers did not need speed as much as they needed brute strength and gentle dispositions. Selecting these qualities led to the development of the various draft breeds.
Breeding for Desired Traits
Breeding also led to characteristics we attribute to certain types. Pleasure horses must have gentle dispositions and pleasing manners. Working cow horses are quick and intelligent—in fact, the cowboy is only along for the ride. Selection for desired traits has led to specialties within breeds. For example, the breed known as thoroughbreds came about because breeders wanted a horse that was “thoroughly bred,” that is, suitable for any use. So, those that have talent for speed are destined for the race track, while other thoroughbreds find their calling as hunter/jumpers, sport horses or saddle horses.

Selecting Breeding Stock
Generally, horses have been selected for breeding purposes because owners wanted to pass on traits—natural ability, speed, endurance, and so on - to the next equine generation. Only those with numerous mares had the luxury of selecting broodmares that not only had the desired traits but were also good candidates because of their reproductive history. At best, owners of mares could select the other parent—the stallion—but unless they chose artificial insemination so they could check sperm mobility and motility, they often did not know that the stallion was in good enough physical condition to bring about fertilization.

General Selection Considerations
Basically, horses are chosen for their suitability to work. Their job may call for an emphasis on conformation, appearance, athletic ability or intelligence. Other factors that influence which horse is ultimately selected are the horse’s conformation, temperament and training.

Breeding and Conformation: When selecting breeding stock, choose a horse whose breeding and conformation suit your needs. Look for a horse that is well proportioned and has the physical traits desired for its purpose—whether jumping, cattle work, dressage or one of the many other areas of ability. Many breeders swear by a physical trait: a certain slope of the shoulder, length of the cannon bone or depth of loin.

Temperament: Others look for a certain temperament as the key to selection. The horse’s temperament is important, particularly when selecting horses for children or nervous adults. Some horses are more naturally calm and more forgiving with inexperienced or rough handlers than others. You may meet an occasional horse who has a poor dispositions which may be due to environment or mood, but there are very few truly mean horses. Retraining can resolve many temperament problems, because most horses have a strong desire to please.

Training: Some buyers want a horse that has not been trained, so they can train it by their own methods; others want a horse that already has a good foundation in whatever discipline they plan to use the horse. Not only is the type of training important, but the prospective owner should note how well the horse responds to training, how well it performs the task for which it was trained and how suited the horse is to the task for which it is being purchased.
Breeding for the Best
Conformation, temperament, training and natural ability are important factors to use in selecting a horse to ride or show, but may not necessarily be the best criteria for selecting horses for breeding purposes. Because horse breeders are not concerned with producing large numbers of offspring, they often use horses that would be culled in any other animal production industry, or they sometimes use horses which are not up to good reproductive standards or abilities at the time of breeding.

Stallions were often kept as long as their offspring numbers and quality remains high, but they are sometimes asked to produce when they are not up to their best condition themselves. Many mares have been kept as brood mares because of other good performance records, regardless of reproductive performance. Such mares may have difficulty in conceiving because of estrus cycle irregularities, they may not have the genetic or physical abilities to carry a foal to term, and they may have problems in foaling. Breeders who are interested in producing quality offspring will also add reproductive efficiently to their list of desired traits worthy of being evaluated.
Reproductive Efficiency
Because horses are not mass-produced for food or fiber in this country, reproductive efficiency has not been the area of intense selection like it has been for other stock animals such as cattle and sheep. Mares have been blamed for conception problems when she was not actually within the best times for conception. Stallions who are brought to mares repeatedly for breeding cannot possibly produce the quality or quantity of sperm necessary for a successful breeding, yet they are often faulted when mares fail to conceive.

Understanding basic equine reproduction and reproduction efficiency will allow owners and breeders to know the best times for breeding for both stallion and mare, thus increasing the chances of fertilization. They will use mares which have proven their ability to carry quality foals to term and which have good mothering instincts. Such attention to reproductive efficiency will assure long lines of strong and healthy horses for years to come.

The Mare’s Reproductive System
Mares have complicated reproductive processes, and they do not easily become pregnant. Each mare has her own reproductive pattern, and knowing that pattern is the key to increasing the chances of fertilization.

Organs of Reproduction: The mare’s reproduction anatomy includes the ovaries, fallopian tubes, uterus, cervix, vagina, clitoris, and vulva.

The ovaries are the main organ of reproduction. These kidney-shaped organs produce hormones and the ova (eggs). The ovaries are small and hard while inactive. However, as the breeding season approaches, the brain secretes a follicle stimulating hormone (FSH), and the ovaries become soft and begin to develop follicles. Luteinizing hormone (LH) causes a follicle to rupture and release an egg. After the egg is released, the follicle becomes a corpus luteum, a structure that—if the mare becomes pregnant—will release the hormones progestin and progesterone to maintain that pregnancy.

Fertilization: After ovulation, the egg travels through the oviduct, where it may be fertilized by sperms cells that are present. If fertilization occurs, the fertilized egg travels to the uterus, where it nestles into the uterus wall and develops into an embryo.

If fertilization does not take place, the corpus luteum will regress (disappear) after about 12 or 14 days, and the estrous cycle will begin again.
The Stallion’s Reproductive System
The stallion is a key part of successful breeding programs. Puberty in stallions begins at approximately 67 weeks of age (about 16 months old). At that time, he begins to produce functional sperm cells.

Organs of Reproduction: The stallion’s reproductive anatomy includes the scrotum, testicles, epididymis, vas deferens, urethra, penis, sheath and internal skin layers and accessory sex glands.

A critical factor in sperm production and quality is temperature. It’s important for the testes—the site of sperm production—to remain several degrees lower than the normal body temperature (100.5° F). The scrotum helps protect the testes against physical and temperature stress. The testicles also contain a muscle (cremaster muscle) that contracts or relaxes to help regulate scrotum temperatures as needed.

Many of the same hormones that influence the reproductive cycle of the mare are involved in the reproductive processes of the stallion. LH is responsible for the production of testosterone by the testes. FSH is responsible for the formation of a protein called androgen binding protein (ABP), which binds and transports testosterone from the testes through the blood to the accessory sex glands.

Sperm Production: Sperm formation takes about 54 days from initial formation to maturity, at which time the cells are capable of traveling to and fertilizing the egg.

Stress: This process may be interrupted by various stresses such as extreme environmental temperatures, illness or fever, nutritional deficiencies, or anxiety. The fertility of the stallion will be greatly decreased, if not completely interrupted, for at least 54 days after the stallion recovers from the stress. If a stallion has a very low sperm count, a second test sample should be taken 60 to 90 days later.

Season: The season of the year has an effect on sperm production. The volume of semen may be reduced by almost half during winter. Mobility of the cells is not affected, but the concentration and total sperm count is greatly reduced during the winter season.
The Estrous Cycle in Mares

Puberty occurs in fillies at approximately 12 to 15 months of age. Normal estrous cycles begin at this age. The normal cycle lasts 21 to 23 days, but there is considerable variation in the cycle length of mares in winter months versus summer months. Mares can be divided into three categories according to the type of seasonal variation they experience: they can be truly polyestrous, seasonally polyestrous, or variantly polyestrous.

Truly polyestrous: Mares continue to cycle throughout the year. Cycles may vary slightly but remain within the normal range.

Seasonally polyestrous: Mares have a definite breeding season (late spring-early summer) and a definite nonbreeding (fall-winter) season.

Variantly polyestrous: Mares have estrous activity during the winter months and early spring, but experience irregularities in all symptoms and behaviors.

Estrus

Approximately 70% of mares ovulate during the last two days of estrus, and about 15% ovulate after estrus. About 50% of mares ovulate without showing estrus (silent heat) at least once within a two-year period. Mares are called long day breeders, which means they are most fertile during the late spring and summer when the ratio of sunlight to dark hours is highest. During early spring, breeders can stimulate an early return to estrus by exposing mares to artificial light for 16 hours a day beginning at 6:00 am. Response time is between 40 and 100 days. Approximately 50% of mares respond to photostimulation by returning to estrus earlier than normal.

Detection of estrus: Knowing when a mare is in estrus is important, because a mare is most like to conceive just prior to ovulation or within the last two day of estrus. Estrus is often detected by teasing the mare with a stallion. Teasing means that the stallion is led near the mares. He is allowed to sniff and nuzzle them. If a mare accepts his sniffing, nuzzling and even biting, she is most likely in estrus. Other reactions that indicate estrus include standing with the tail raised and feet apart and pelvis flexed, frequent urination and winking (contraction, relaxation) of the vulva.
Breeding

For this study guide, the term *breeding* encompasses both the physical act and the resulting pregnancy and foaling. The next sections will cover natural and artificial methods of breeding, and the resulting pregnancy if fertilization does take place.

Natural Breeding
The best time to breed a mare is just prior to ovulation, or within the last two days of estrus. The breeder should keep records of brood mares to determine her estrus cycle. Then, if estrus has been confirmed with teasing and if the length of a typical estrus is known, the breeder can calculate the best time to bring in the stallion for mating. This procedure will prevent stressing the stallion or mare due to excess mating when there is little likelihood of conception.

Preparing the Mare and Stallion for Breeding: If the mare is in estrus, she will empty her bladder when exposed to a stallion. The tail should be wrapped to keep it out of the way. The vulva should be washed with a mild soap and thoroughly rinsed, because the clitoris might harbor microorganisms that can cause venereal disease in the foal, a leading cause of fetus abortion. The stallion's penis should be washed before and after breeding.

The breeding area should be large enough for the mare to get away from the stallion if she becomes nervous during the teasing process. The mare should be restrained before breeding for her safety, the safety of the stallion and the handlers' safety. Once the mare is restrained, the stallion may be brought in and allowed to mount the mare.

Artificial Insemination
There are many advantages to artificial insemination, including increased numbers of offspring from superior stallions, reduced disease transmission and less risk of injury to stallions or mares that may occur during natural breeding.

For artificial insemination, semen is collected from the stallion and evaluated. If deemed acceptable, it can be used raw or extended for use in more than one mare. The semen can be used immediately or may be stored in the refrigerator or frozen for later use or for shipment to another mare.

In the artificial insemination process, a catheter is inserted into the mare’s uterus. Then, semen is drawn up into a sterile syringe and expelled through the catheter, thus placing the semen into the mare’s uterus. If the mare ovulates during the time the sperm is active, a pregnancy is almost certain to occur.
Pregnancy Determination
The most common methods of determining pregnancy in mares are rectal palpation, ultrasound, and blood testing.

Rectal palpation is accurate when performed by a skilled technician. However, early pregnancies (earlier than 20 days) are difficult to diagnose because of the tiny size of the fetus.

Ultrasound can detect a pregnancy as early as 11 days after ovulation. Ultrasound may be less accurate in later pregnancies when the fetus is too large to fit on the screen.

Blood testing can detect pregnancies between 45 and 140 days. A hormone called pregnant mare serum gonadotropin is present in the blood at this time. The hormone is only present in pregnant mares.

Care of the Mare and Pregnancy Complications
Pregnant mares should be kept in an area where they can get adequate exercise and can be ridden as usual until the last months, and then can still be ridden with care because they benefit from the exercise and consistency of routine. Mare should be given the best of nutrition during all stages of pregnancy.

Gestation normally lasts between 335 and 340 days. The length of gestation can be affected by time of the year (shorter gestation period in warm months), sex of the foal (colts are carried 2-7 days longer than fillies), and nutrition level of the mare (high level of nutrition means birth about 4 days earlier). At about 1/3 of the way through the gestation period, the foal is well defined: hairless with eyes closed; hooves, tongue, palate, tail, and genitalia already well-formed.

Pregnancy Complications: One of the reasons that reproductive efficiency is important in selecting a brood mare is that mares have a higher incidence of spontaneous abortion, or miscarriage, than do other livestock. Chronic miscarriage can be caused by venereal disease or structural problems that prevent the fetus from being carried to term. Acute abortions occur when bacteria enter the uterus and causes the death of the fetus. Twinning may also cause miscarriage. The incidence of twins surviving to birth is very low. Reasons for miscarriage of twins may be lack of uterine space or inadequate nutrition. One if not both twins usually die early in gestation.

Foaling
Foaling is the term for the birth process. The baby is called a foal whether it is male or female. A colt is a male foal; a filly is a female foal. The next sections will discuss the steps to watch for in the foaling process, and you will be given suggestions in how to take care of the mare and foal after delivery.

**Parturition**

Anytime after 330 days you can expect the mare to begin the foaling (also called birthing or parturition) process. The mare’s abdomen will be enlarged, the blood vessels that supply the udder will swell, and the muscles over the hip will relax, and the croup will jiggle to the touch. Anywhere from two weeks to just before delivery, the mare’s teats may wax, or dip the first milk.

*Preparations:* The stall where the foaling takes place should be large and bedded down with straw. Don’t use shavings because they will stick to the newborn and the foal may inhale the shavings. Wrap the mare’s tail to keep it dry and out of the way.

Foaling occurs in four stages.

1. **The first stage** is marked by uterine contractions and dilation of the cervix. The mare may lay down, roll, sweat, and otherwise act as if she has colic. She will show signs of strain on her face. While distressing for the person watching, the foaling is progressing normally. Stage one ends when the water bag breaks, spilling between two and five gallons of liquid.

2. **The second stage** is indicated by a marked effort by the mare to push the foal out. This stage usually lasts about a half hour, but can take up to an hour. The first thing you should see is both hooves pointing downward. If only one hoof, or the head appears, then the foal is not positioned correctly and you should get medical help to reposition the foal. Even if the head appears during this stage, do not remove the placenta because the foal may be pulled back into the mare’s body and suffocate.

3. **The third stage** brings the foal into the world as the mare pushes the baby out. If needed, you may remove the sack from around the foal’s head. **DO NOT** cut the umbilical cord, however. Let the mare and foal break it naturally so the foal does not suffer from loss of blood while the cord is still functional.

4. **The fourth stage** is expulsion of the fetal membranes, also called the placenta. The placenta (now dying tissue) must be expelled or it can infect the mare. If the mare hasn’t expelled the placenta within 4 hours, or if it’s not intact, get medical assistance. The placenta, which is now dying matter, can causes serious infection if not expelled.
Post-Delivery Care
After giving birth, the mare should be examined to determine whether she has been injured during the delivery process.

The foal should also be examined to be sure it is breathing and does not have delivery injuries. Now is a good time to vaccinate the newborn with tetanus antitoxin. When the umbilical cord breaks, treat the stub with 3% to 5% iodine to prevent infection. The foal should pass the first feces within the hour, or an enema may be necessary to remove them.

This is the time that imprinting can most easily be accomplished. In imprinting, the human (usually veterinarian or the owner) desensitizes the foal by rubbing and holding parts of the foal’s body so that the foal will accept the human touch and smell as natural.

Almost immediately, and certainly within the first 24 hours, the foal should drink its mother’s first milk, called colostrum, which is rich in antibodies for diseases to which the mare has been exposed. For the rare occasions when mares refuse to nurse their foals, you can feed the baby using the frozen colostrum you collected prior to birthing, or you can purchase milk replacement with colostrum to feed to the foal.

Conclusion
The beautiful, graceful horse has been bred for many traits throughout history, with breeders encouraging characteristics such as endurance, color combinations, intelligence, agility, size, or any other number of traits for the work the horse would do. However, reproductive performance has not typically been the main criteria for equines as it has been for other herd animals. Therefore, a successful horse breeding has often been based mostly on guess, chance, and hope—the owner guessed the mare was ready to mate, they took a chance the stallion did his job, and they hoped for a pregnancy and foaling.

A well-informed breeder looking to increase the quality of the next generation should understand the basics of horse reproduction. The breeder will make sure the stallion is in tip-top shape in order to capture quality sperm. The breeder will look for signs that the mare is in her estrus cycle, breed at the best time for conception, give the mare good pregnancy care, and use brood mares that demonstrate the ability to carry quality foals to term. By adding reproductive efficiency to the list of other traits we deem valuable in horses, we will make sure the beauty, grace and usefulness of these marvelous creatures is kept at its natural best.
Equine Reproduction
Female (dam) Anatomy

1. Ovary:

2. Oviduct:

3. Fimbria:

4. Uterus:

5. Cervix:

6. Vagina:

7. Vulva:

8. Clitoris:
Equine Reproduction
Male (sire) Anatomy

1. Testes:

2. Scrotum:

3. Epididymis:

4. Vas deferens:

5. Penis:

6. Prepuce:

7. Accessory sex glands:
Equine Reproduction

Discussion/Written Questions

1. Discuss selection of breeding stock. What factors in breeding have been considered important, and what other factors of reproductive efficiency should be considered?

2. Characterize the three types of seasonal variation in estrus seen in horses. How can a mare with a definite summer estrus be manipulated to come into an earlier cycle?

3. Discuss estrus detection in mares - the method used, what indications, etc.

4. Explain factors that may influence sperm production in stallions.
Matching

Place the correct letter in the blank by the statement.

a. cervix  e. scrotum  i. testes
b. accessory sex glands  f. ovary  j. vulva
c. oviduct  g. uterus
d. vas deferens  h. epididymis

___ 1. site of sperm storage and maturation
___ 2. releases egg and estrogen
___ 3. external opening of mare’s reproductive tract
___ 4. provides nutrients and buffer for sperm
___ 5. location of fetus during gestation
___ 6. protects testes from environment
___ 7. separates vagina from uterus
___ 8. site of sperm production
___ 9. passage for sperm from testes to pelvic region
___ 10. passage for egg to uterus; site of fertilization
Equine Reproduction: Quiz I

Multiple Choice

___ 1. Most mares ovulate
   a. on the first day of estrus
   b. in the last two days of estrus
   c. after estrus
   d. before estrus

___ 2. Luteinizing hormone is not responsible for
   a. ovulation
   b. testosterone production
   c. formation of the follicle
   d. formation of the corpus luteum

___ 3. Normal gestation lasts
   a. 335 - 340 days
   b. 320 - 325 days
   c. 340 - 345 days
   d. 330 - 335 days

___ 4. Fillies reach puberty at approximately
   a. 10 - 12 months
   b. 12 - 15 months
   c. 15 - 17 months
   d. 17 - 19 months

___ 5. Which is not a sign of estrus?
   a. winking of the vulva
   b. frequent urination
   c. standing with feet apart
   d. rapid switching of the tail

True or False

___ 6. Blood testing can detect pregnancies between 45 and 140 days, due to a hormone called progesterone.

___ 7. If a mare is in estrus, she will empty her bladder when exposed to a stallion.

___ 8. The best time to breed a mare is within the last two days of estrus.

___ 9. A critical factor in sperm production and quality is temperature.

___ 10. Acute abortions occur when bacteria enter the uterus and cause the death of the fetus.
Equine Reproduction: Foaling
Quiz II

Multiple Choice

___ 1. A regular de-worming schedule should take place
   a. once a month
   b. once a year
   c. every two months
   d. five times a year

___ 2. What distinctive signs will a mare exhibit toward the end of gestation and prior to foaling?
   a. large abdomen
   b. waxing of teats
   c. carrying the foal very low
   d. all of the above

___ 3. At what point does stage one end?
   a. placenta appears
   b. water bag breaks
   c. croup becomes very flaccid
   d. both a and b

___ 4. The foal should nurse as soon as possible
   a. to receive the mare’s colostrum
   b. to prevent starvation
   c. to prevent dystocia
   d. none of the above

___ 5. The placenta is considered retained when it
   a. has missing parts
   b. has completely passed from the mare
   c. has not been passed within four hours
   d. both a and c
Equine Reproduction  
*(Answer Key)*

1. Abortion:  
   Death of the fetus due to infection or uterine inadequacy in the mare.

2. Colostrum:  
   First milk produced shortly after parturition. Passes immunity to the foal. Contains antibodies to disease to which the mare has been exposed.

3. Dystocia:  
   Difficulty giving birth.

4. Gestation:  
   Growth and development of the young in the uterus.

5. Immune:  
   Resistant to disease due to prior exposure to an antigen (disease factor) of some sort. May come from vaccines or direct exposure to the disease.

6. Placenta:  
   Fusion of the fetal membranes to the lining of the uterus, which permits passage of oxygen, etc., between the mare and the fetus.

7. Umbilical cord:  
   Lifeline to the fetus. Long, flexible tube that enables the fetus to receive nutrients and dispose of wastes. Attaches to the placenta at one end and the abdomen of the fetus at the other.
Equine Reproduction
Female (dam) Anatomy

1. Ovary:  
The essential reproductive organ of the mare; produces the hormone estrogen; site of egg production.

2. Oviduct:  
The passage for the egg to the uterus; site of fertilization.

3. Fimbria:  
Funnel-shaped end of the oviduct near the ovary; catches the egg and funnels it into the oviduct.

4. Uterus:  
Site where fetus implants and develops through gestation.

5. Cervix:  
Separates the uterus from the vagina; prevents bacteria and debris from entering the uterus.

6. Vagina:  
Site where semen is deposited during natural breeding.

7. Vulva:  
External portion of the female reproductive tract.

8. Clitoris:  
Structurally related to the penis in the male; it arises from the same embryonic tissues.
Equine Reproduction
Male (sire) Anatomy

1. Testes:
   Site of sperm production; produce the male hormone testosterone.

2. Scrotum:
   Protective sack around the testes; helps to regulate the temperature of
   the testes. The cremaster muscle contracts to draw the testes up toward
   the body during cold weather to keep them warm, and relaxes to lower
   them away from the body to keep them cool when the weather is hot.

3. Epididymis:
   The site of sperm storage and maturation.

4. Vas deferens:
   The passageway for the sperm to pass from the epididymis to the urethra
   and accessory sex glands in the pelvic region.

5. Penis:
   The copulatory organ of the stallion.

6. Prepuce:
   Loose surrounding skin that protects the free end of the penis.

7. Accessory sex glands:
   Contribute fluids that serve as a buffer and source of nutrients for the
   sperm cells: bulbourethral gland, prostate gland, vesicular gland.
1. Discuss selection of breeding stock. What factors in breeding have been important, and what other factors of reproductive efficiency should be considered?

   Man has mated horses for traits geared toward the work the horse would do: racehorses were bred for speed; war horses for agility and endurance, show horses for conformation, draft horses for strength and docility, and so on. Although this type of selective breeding produced the characteristics the man desired, it was a slow and haphazard process because little thought was given to the condition and reproductive readiness of the stallion and mare at the time of the mating. Mares that did not produce a foal within a year or two were culled, when the fault may have lay with timing of her estrus cycle or poor sperm quality from the stallion—not her ability to conceive. Stallions were mated repeatedly and faulted when the mares didn’t conceive, when the problem may have that the mare ovulated long after the mating and fertilization didn’t take place, or the problem may have been low sperm production that could be easy cured with rest. Mares who did conceive easily were often used as brood mares when they were not the best choices at all, due to high rates of abortion, genetic weaknesses, or delivery difficulties—risking the life of both foal and dam, and lowering the quality of the offspring.

   Knowledgeable breeders will use factors of reproductive efficiency: quality brood mares with a proven ability to carry quality foals to term, careful attention to make sure the mare is in estrus, mating at the optimum time for conception or use of artificial insemination at the right time, using a stallion who is rested, not under stressed conditions, and able to produce good quality and quantity of sperm.

2. Characterize the three types of seasonal variation in estrus seen in horses. How can a mare with a definite summer estrus be manipulated to come into an earlier cycle?

   A mare can be **Truly Polyestrous**, which means she cycles each month throughout the year. Such a horse will have several opportunities to conceive, and the owner should be able to detect estrus through familiarity with the monthly cycle. The owner may have to guard against her conceiving at times when it is not desired (for example, birthing in the winter is not as desirable as a spring foaling).

   Or the mare can be **Seasonally Polyestrous**, meaning she has a definite breeding cycle, usually late spring/early summer, and a definite non-breeding season. Owners will have to watch for her cycle
to mate at the proper time, and she will not have as many opportunities for natural breeding conception.

The third type of estrus variation is *Variantly Polyestrous*. In this case, the mare comes into estrus during the winter or early spring months, but either shows few of the typical outward signs so the owners knows she is ready to mate, she may go in and out of estrus and thus lessen the chance of conception, or she may conceive at a poor time of the year for optimum foaling conditions.

A horse breeder may wish to bring a mare into cycle in spring instead of in summer. That way, the foal will be born the following spring and weaned when the grass is growing and is at its highest nutrition level. Timing is also important in certain age-regulated activities, such as racing, because for these activities, all horses are considered a year older in January. Therefore, an earlier foaling will allow more growth and maturity than a late-in-the-year foaling. Most mares will come into estrus seasonally. They are called “long day breeders” because their cycle is brought on by the longer days of sunlight found in the late spring and summer. Mares can be brought into an earlier estrus by exposing them to artificial light for 16 hours a day to simulate the long days of sunlight during her usual late spring/early summer estrus cycle. Half the mares will respond to the light by coming into estrus about 30-40 days earlier than usual.

3. Discuss estrus detection in mares-- the method used, what indications, etc.

Because horses mate only when the mare is “in season,” it is important to know when she is ready to accept mating. And, because she is most likely to conceive within the last two days of her estrus cycle, knowing when she begins her cycle is important.

The mare will probably show signs of estrus: standing with tail raised and legs apart, pelvis flexed, “winking” of the vulva, frequent urination. Unfortunately, not all mares show these outward indications. “Teasing” is the traditional way of detecting estrus. The stallion can sense and smell her readiness to mate when she is in her cycle, and he displays mating-type behavior: sniffing and nuzzling of her vulva, playing behavior that may include nipping and biting, and attempts to mount her. Only when a mare is in estrus and willing to mate will she accept and even encourage this behavior. The owner who knows the particular cycle of the mare will know the best time to bring the stallion in for mating. Most mares ovulate within the last two days of their cycle, although a few may ovulate right after estrus; breeders should attempt mating during these times.
4. Explain factors that may influence sperm production in stallions.

In order to produce good quality sperm in sufficient volume, the testes (site of sperm production) must be kept several degrees cooler than the rest of his body. The stallion’s scrotum acts as a temperature insulator, and his cremaster muscle also helps regulate temperature by raising or lowering the testes as the body heat of the stallion increases or decreases.

Another factor in lack of producing good quality sperm is stress. A stallion under stressful condition, such as going on the show circuit, being a working cow horse, or being made to mate excessively, will not be able to produce the amount of sperm it may take for a successful mating. Other factors also lessen the amount or sperm being produced or the quality of the sperm: illness, fever, nutritional deficiencies, extreme environmental temperatures (hot barn or an especially hot month). Also, semen volume may be about half in the winter season—which means the concentration and total sperm count is greatly reduced during winter months.

Because sperm takes about 54 days from initial formation to reach maturity and fertilization level, a stallion that shows a low sperm count should be rested and given good care and food, then re-tested after at least 60 days.
# Equine Reproduction

(Answer Key)

**Matching**

Place the correct letter in the blank by the statement.

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<table>
<thead>
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<tbody>
<tr>
<td><strong>a. cervix</strong></td>
<td><strong>e. scrotum</strong></td>
<td><strong>i. testes</strong></td>
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<tr>
<td><strong>b. accessory sex glands</strong></td>
<td><strong>f. ovary</strong></td>
<td><strong>j. vulva</strong></td>
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<tr>
<td><strong>c. oviduct</strong></td>
<td><strong>g. uterus</strong></td>
<td></td>
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<tr>
<td><strong>d. vas deferens</strong></td>
<td><strong>h. epididymis</strong></td>
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1. site of sperm storage and maturation
2. releases egg and estrogen
3. external opening of mare’s reproductive tract
4. provides nutrients and buffer for sperm
5. location of fetus during gestation
6. protects testes from environment
7. separates vagina from uterus
8. site of sperm production
9. passage for sperm from testes to pelvic region
10. passage for egg to uterus; site of fertilization
Equine Reproduction: Quiz I (Answer Key)

Multiple Choice

1. Most mares ovulate
   a. on the first day of estrus
   b. in the last two days of estrus
   c. after estrus
   d. before estrus

2. Luteinizing hormone is not responsible for
   a. ovulation
   b. testosterone production
   c. formation of the follicle
   d. formation of the corpus luteum

3. Normal gestation lasts
   a. 335 - 340 days
   b. 320 - 325 days
   c. 340 - 345 days
   d. 330 - 335 days

4. Fillies reach puberty at approximately
   a. 10 - 12 months
   b. 12 - 15 months
   c. 15 - 17 months
   d. 17 - 19 months

5. Which is not a sign of estrus?
   a. winking of the vulva
   b. frequent urination
   c. standing with feet apart
   d. rapid switching of the tail

True or False

6. Blood testing can detect pregnancies between 45 and 140 days, due to a hormone called progesterone.
   hormone called -- pregnant mare serum gonadotropin

7. If a mare is in estrus, she will empty her bladder when exposed to a stallion.

8. The best time to breed a mare is within the last two days of estrus.
   last two days of -- ovulation

9. A critical factor in sperm production and quality is temperature.

10. Acute abortions occur when bacteria enter the uterus and cause the death of the fetus.
Equine Reproduction: Foaling
Quiz II
(Answer Key)

Multiple Choice

c 1. A regular de-worming schedule should take place
   a. once a month
   b. once a year
   c. every two months
   d. five times a year

d 2. What distinctive signs will a mare exhibit toward the end of gestation and prior to foaling?
   a. large abdomen
   b. waxing of teats
   c. carrying the foal very low
   d. all of the above

d 3. At what point does stage one end?
   a. placenta appears
   b. water bag breaks
   c. croup becomes very flaccid
   d. both a and b

a 4. The foal should nurse as soon as possible
   a. to receive the mare's colostrum
   b. to prevent starvation
   c. to prevent dystocia
   d. none of the above

d 5. The placenta is considered retained when it
   a. has missing parts
   b. has completely passed from the mare
   c. has not been passed within four hours
   d. both a and c